Unit 1: Introduction to Anatomy

1) Describe the anatomical position.
   Standing up, facing forward, feet pointed forward and slightly apart, and arms hanging down at the sides with palms facing forward (thumbs out).

2) Distinguish between the science of anatomy and the science of physiology.
   Anatomy: names of structures
   Physiology: how structures work

3) Define homeostasis.
   Tendency toward a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes.

4) Distinguish between superficial and deep.
   Superficial: closer to the surface of the body. Deep: farther from the surface of the body (more internal).

5) Distinguish between the following reference terms:
   a. anterior vs. posterior: anterior is towards the front and posterior is towards the back
   b. superior vs. inferior: superior is above and inferior is below
   c. proximal vs. distal: proximal is closer to the point of reference and distal is farther from the point of reference (attachment)

6) Identify each numbered structure by labeling the following figures:

   Figure 1.1: Planes of the Body
   - 65) frontal (coronal)
   - 66) transverse
   - 67) sagittal (midsagittal)

   Figure 1.2: Human Body Orientation & Direction
   - 68) superior
   - 70) inferior
   - 69) posterior (or dorsal)
   - 71) anterior (or ventral)
   - 72) proximal
   - 73) distal
Distinguish between the following movement terms:

a. extension vs flexion: extension: describing a straightening movement that *increases* the angle between body parts and flexion: bending movement that *decreases* the angle between a segment and its proximal segment

b. circumduction vs rotation: circumduction: circular movement of a limb and rotation: towards or away from the center of the body

c. abduction vs adduction: abduction: motion that pulls a structure or part *away from* the midline of the body and adduction: motion that pulls a structure or part *toward* the midline of the body

4) Name the body cavity that contains each of the following organs:

- Stomach: **ABDOMINAL**
- Heart: **THORACIC** (pericardial)
- Brain: **CRANIAL**
- Liver: **ABDOMINAL**
- Trachea: **THORACIC**
- Rectum: **PELVIC**
- Spleen: **ABDOMINAL**
- Esophagus: **THORACIC**
- Spinal cord: **VERTEBRAL**
- Ovaries: **PELVIC**
- Lungs: **THORACIC** (pleural)
- Urinary bladder: **PELVIC**

Unit 2: Skin/The Integumentary System

1) List 5 functions of the SKIN.

1. Thermoregulation
2. Protection (non-specific immunity)
3. Retards (slows) water loss
4. Excretes wastes
5. Holds sensory receptors (pain, touch,..)
6. Synthesis of biochemicals (ex: Vitamin D)

2) List the four types of tissue and examples from each.

1. Epithelial (covering) → lining small intestine, heart, and uterus
2. Connective (support) → ligament, tendon, blood
3. Muscle (movement) → biceps
4. Nervous (control) → nerves (neurons and glial cells)

3) What is the difference between a **LIGAMENT** and a **TENDON**? What is a similarity in regards to healing (what causes this similarity)?

Ligament attaches one bone to another bone whereas a tendon attaches (connects) a muscle to a bone

Neither are well vascularized so they take a long time to heal

4) List the three layers of skin.

- Epidermis
- Dermis
- Hypodermis (subcutaneous)

5) List the 5 epidermal layers (in order). **THIS IS FROM THE BOTTOM GOING UP**

1. Stratum basale (germanitivum) (basal layer) **MITOSIS!!!**
2. Stratum spinosum (prickly layer)
3. Stratum granulosum (granular layer)
4. Stratum lucidum (clear layer)
5. Stratum corneum (horny layer)
6) What do fibroblast cells produce and in which layer of skin are they found?  
Fibroblast cells produce collagen and fibrin (divide more during wound healing); found in dermis

7) What is the difference between a sebaceous gland and a sudoriferous gland?  
sebaceous gland: oil glands (usually associated with hair follicles)  
sudoriferous gland: sweat glands

8) Explain what happens to epidermal cells as they undergo KERATINIZATION.  
Cells divide by mitosis in stratum basale. As new cells continue to divide and form in that layers, previously made cells as pushed upwards. As the cells move upwards, keratin begins to fill the cells and by the time they reach the top layer (stratum corneum), the cells are full of keratin and are dead. The keratin filling the cells is what makes the skin a protective barrier.

9) What is a blister? Partial separation between epidermis and dermis that is filled with lymph fluid

10) List the types of burns and a brief explanation of each.  
1st degree: only epidermis is affected; red and painful  
2nd degree: epidermis and upper region of dermis is affected; red, painful and blistered  
3rd degree: entire thickness of skin is affected; white or black, not painful (nerves are destroyed)

11) Why are 3rd degree and critical burns life threatening (2 reasons)?  
1) risk of infection  
2) loss of fluids

Unit 3: The Skeletal System  
1) Differentiate between the axial and appendicular skeletons.  
The axial skeleton consists of bones along the axis of the body (vertebral, thoracic, cranial). The appendicular skeleton consists of the bones of the appendages (arms & legs) and the girdles (shoulder and pelvic) that connect them with the axial skeleton.

2) List four functions of the human skeletal system.  
Support and protection  
Body movement (since bones are the attachment place for muscles)  
Blood cell formation (hematopoiesis)  
Storage of inorganic salts
3) Sketch a typical long bone and label the diaphysis, epiphyses, periosteum, endosteum, epiphyseal plate, medullary cavity, spongy bone, compact bone, articular cartilage

4) Distinguish between osteocytes, osteoblasts, and osteoclasts.
   **Osteocytes:** mature bone cells
   **Osteoblasts:** bone forming cells
   **Osteoclasts:** bone dissolving cells (break down bone)

5) Which cells release calcitonin and why? **Thyroid cells release calcitonin in order to decrease levels of calcium in the blood** (maintain calcium homeostasis); **osteoblasts respond to this hormone and remove calcium from bones and add it back into the blood**

Which cells release parathyroid hormone and why? **Parathyroid hormone is released from the parathyroid gland to bring calcium levels back up**; **osteoclasts respond to this hormone and remove calcium from bones and add it back into the blood**

6) Where are RBC, WBC, and platelets made? **Red bone marrow**

What causes RBC’s to be made? **When low oxygen levels are detected, erythropoietin (EPO) is released which causes stem cells in the red bone marrow to make more RBC’s**

7) List the types of synovial joints with an example of each.
   **Gliding:** carpals (wrist)
   **Hinge:** elbow
   **Pivot:** radius and ulna
   **Ball and Socket:** femur hip; humerus to shoulder
   **Saddle:** (thumb)
   **Condyloid:** ends of finger bones

**You need to know the names of bones and where they are located.**
Unit 4: The Muscular System

1) Distinguish between skeletal, smooth, and cardiac muscle. Include where in the body each type of muscle is found.

<table>
<thead>
<tr>
<th>Muscle Type</th>
<th># of nuclei per cell</th>
<th>Striated?</th>
<th>Voluntary/Involuntary?</th>
<th>Function/where found</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth</td>
<td>1</td>
<td>No</td>
<td>invol</td>
<td>Lines organs; surrounds breathing tubes</td>
<td>Electrical impulse passed directly from cell to cell</td>
</tr>
<tr>
<td>Cardiac</td>
<td>1</td>
<td>Yes</td>
<td>Invol</td>
<td>Heart</td>
<td>Electrical impulse passed directly from cell to cell</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Many (multi)</td>
<td>Yes</td>
<td>vol</td>
<td>Attached to bones</td>
<td>Motor neuron electrical impulse passes to chemical message to start electrical in fiber</td>
</tr>
</tbody>
</table>

2) What is the significance of acetylcholine and acetylcholinesterase?

**Acetylcholine** (ACh): neurotransmitter that is released from a motor neuron; binds to a muscle cell (fiber) causing the initiation of a muscle contraction

**Acetylcholinesterase**: enzyme found in the synaptic cleft (space between motor neuron and muscle cell) that breaks down acetylcholine. That way when your brain stops sending messages down the motor neuron, the ACh will be broken down and the electrical impulse will no longer travel down the muscle cell’s T-tubule

3) Summarize the steps of the sliding filament model of contraction. Include the roles of: actin, myosin, troponin, tropomyosin, acetylcholine, calcium ions, sarcoplasmic reticulum, transverse tubules, acetylcholinesterase.

1. An electrical impulse (action potential) travels down a motor neuron and reaches the end.
2. When the electrical impulse reaches the end, this causes the vesicles containing ACh to empty into the synaptic cleft by exocytosis.
3. ACh neurotransmitter diffuses across this neuromuscular junction space and binds to ACh receptors embedded within the muscle fiber’s plasma membrane (sarcolemma).
4. When ACh binds to these receptors, this causes a new impulse in the muscle fiber.
5. The electrical impulse travels down the T-tubules which causes Ca^{2+} channels in the sarcoplasmic reticulum to open.
6. Ca^{2+} rushes out of the SR and binds to troponin.
7. When Ca^{2+} binds to troponin, this causes it to change shape.
8. The change in troponin’s shape causes it to pull on tropomyosin exposing the myosin cross-bridge sites.
9. Myosin is already in its high energy position (conformation) and immediately binds to the cross bridge site on actin.
10. The energy in the myosin head is released and the myosin head falls down to its low energy position (conformation).
11. When it moves to its low energy position, it pulls on the actin filament and actin moves towards the center of the sarcomere.
12. ATP binds to the myosin causing the cross bridge to break.
13. ATP splits (hydrolyzes) into ADP & P and this energy causes the myosin head to return to its high energy position.
14. As long as Calcium is present, another cross bridge will form and steps #9–13 will repeat.
15. When the electrical message stops being sent (because you want to stop the muscle contraction), Acetylcholinesterase will break down the ACh in the synaptic cleft.
16. The electrical impulse no longer passes through the T-tubules and the Calcium pumps in the SR membrane pumps the Calcium back into the SR.
17. Troponin returns to its original shape which causes tropomyosin to cover up the cross bridge binding sites on actin.
18. The actin filaments slide back out.

4) Draw and label a sarcomere.

5) List three functions of the muscular system.
   1) movement
   2) thermogenesis (generates heat)
   3) posture & body/joint support

6) List the muscles involved in:
   a. chewing: Temporalis and Masseter
   b. winking: Orbicularis oculi
   c. puckering lips as if to whistle: Orbicularis oris
   d. bend the head toward the chest (if both of same named muscle contract simultaneously; turn head to look out if only 1 of them contracts): Sternocleidomastoid
   e. moving the abdominal wall in a sit up: Rectus abdominus
   f. moving the abdominal wall by rotating to one side: External abdominal oblique
   g. extending forearm: Triceps brachii
   h. flexing forearm: Biceps brachii
   i. extending lower leg: Quadriceps
   j. flexing lower leg: Hamstrings
   k. breathing: external and internal intercostals
   l. abducting the whole arm: deltoïd
7) What is a motor unit? **1 motor neuron and all the muscle fibers it passes its message to** → see diagram to right; it has 2 motor units - red & blue

8) What occurs in tetanus? **summation of twitches to cause a contraction** (twitch: 1 single impulse from motor neuron)

9) What is tonus? Provide one example. **Partial contraction of some of your muscles; you sitting in your chair**

10) Match the movements in column I with the description in column II.

<table>
<thead>
<tr>
<th>ANSWERS:</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>1. rotation</td>
<td>a. turning palm upward</td>
</tr>
<tr>
<td>a</td>
<td>2. supination</td>
<td>b. decreasing angle between parts</td>
</tr>
<tr>
<td>f</td>
<td>3. extension</td>
<td>c. moving part forward</td>
</tr>
<tr>
<td>e</td>
<td>4. eversion</td>
<td>d. moving part around an axis</td>
</tr>
<tr>
<td>c</td>
<td>5. protraction</td>
<td>e. turning sole of foot to face laterally</td>
</tr>
<tr>
<td>b</td>
<td>6. flexion</td>
<td>f. increasing angle between parts</td>
</tr>
<tr>
<td>h</td>
<td>7. pronation</td>
<td>g. lowering a part</td>
</tr>
<tr>
<td>i</td>
<td>8. abduction</td>
<td>h. turning palm downward</td>
</tr>
<tr>
<td>g</td>
<td>9. depression</td>
<td>i. moving part away from midline</td>
</tr>
</tbody>
</table>

UNIT 5: The Nervous System

1) List and briefly describe the three general functions of the nervous system.

1: sensory
2: integration
3: motor output

2) Distinguish between the following pairs (or groups) of terms:
   a. sympathetic and parasympathetic nervous system
      **Sympathetic nervous system:** fight or flight response → specific areas of your body are “targeted” by adrenaline (epinephrine) to increase glucose & oxygen in your blood and take away waste products of cellular respiration faster
      **Parasympathetic system:** “rest & digest” → when your body is doing what it normally does at its normal pace; digesting food, making urine, etc
   b. dendrite and synapse
      **dendrite:** where information comes into the neuron; where receptors for neurotransmitters are located
      **synapse:** the junction between a neuron and another cell (neuron, muscle cell, gland cell)
   c. central and peripheral nervous system (CNS vs PNS)
      **CNS:** brain and the spinal cord. All together, the brain and the spinal cord serve the nervous system's command station
      **PNS:** contains the nerves, which leave the brain and the spinal cord and travel to certain areas of the body. The peripheral nervous system's main job is to send information gathered by the body's sensory receptors
to the CNS as quickly as possible. Once the CNS has understood the information, the PNS will relay the specific orders back out the body.

d. somatosensory cortex and motor cortex (these are next to each other in the cerebral cortex of the brain)

**somatosensory cortex**: region of cortex where different types of sensation are processed

**motor cortex**: deals with movement of different parts of the body

e. sensory neuron, interneuron, and motor neuron

**sensory neuron**: neuron taking information to the CNS

**interneuron**: neuron where process & integration occurs

**motor neuron**: neuron taking information away from the CNS to the effector (muscles)

3) List the events during an ACTION POTENTIAL. Include the events that occur when that action potential reaches a synapse and is passed to another neuron.

1) **Resting potential**: neuron cell is at approximately -70 mV. Na & K gates are both closed

2) **Depolarization**: stimulus increase the membrane potential to -55mV and as a result, has crossed the “threshold” to fire an action potential; Na gates open and Na rushes into the cell; cell becomes more positive on the inside

3) **Repolarization**: Na gate closes & K gate opens; K moves out of the cell and this decreases the membrane potential inside the cell (it becomes more negative)

4) **Undershoot**: K gate is slow to close so too much K leaves the cell (Na gate still closed); cell becomes even more negative

**Refractory time period**: time between action potentials when the Na/K pump “resets” the ion concentrations (Na pumped back out & K pumped back in; uses ATP)

*Action Potentials continue to occur down the axon until it reaches the synaptic end bulb. Once the electrical impulse reaches there, the vesicles, which contain neurotransmitter, merge with the membrane and release the neurotransmitters into the synaptic cleft

4) How does 1 action potential cause the next action potential farther down the axon in a myelinated neuron?

The depolarization (positive charge) that results from the rush of sodium ions into the neuron causes the next sodium gate to open on the other side of some myelin (start of the next action potential)

5) What causes an increase in pain between a slight pinch vs. a hard pinch?

A hard pinch causes more action potentials to fire (increase the frequency of action potentials)

6) What is the function of the neurotransmitter ACh in a motor neuron?

Once released from the motor neuron, it binds to a muscle cell to start the contraction of a muscle cell (once it binds, electrical impulse travels down T-tubule, which depolarizes sarcoplasmic reticulum, which then releases calcium… (see Muscular System Unit Q#3 for the rest)
7) What is the function of dopamine in the brain? It is a **neurotransmitter** that binds to the pleasure center in the brain; involved in reward center of brain (mood)

8) List the parts of the brain with a brief function of each.

<table>
<thead>
<tr>
<th>Part of the Brain</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEREBRUM</td>
<td>thinking; personality; memory; main integration</td>
</tr>
<tr>
<td>CEREBELLUM</td>
<td>coordinates where your body is in space &amp; time; major muscular coordination</td>
</tr>
<tr>
<td>BRAIN STEM</td>
<td>vital reflexes for homeostasis (coughing, sneezing, vomiting, breathing)</td>
</tr>
<tr>
<td>DIENCEPHALON</td>
<td>homeostasis (hunger, thirst, body temp), biological clock, relay center</td>
</tr>
</tbody>
</table>

9) List the parts of the cerebrum with a brief function of each.

<table>
<thead>
<tr>
<th>Lobe</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal lobe</td>
<td>Thinking; reasoning; planning; emotions; problem solving; part of the speech process; movement</td>
</tr>
<tr>
<td>Parietal lobe</td>
<td>Movement; orientation; perception of sensory stimuli (somatosensory processing)</td>
</tr>
<tr>
<td>Temporal lobe</td>
<td>Perception &amp; recognition of auditory stimuli; memory; speech</td>
</tr>
<tr>
<td>Occipital lobe</td>
<td>Visual processing</td>
</tr>
</tbody>
</table>

10) List the parts of a reflex arc.

Sensory receptor → sensory neuron → integration (interneuron) → motor neuron → effector

**UNIT 6: Blood / The Circulatory System**

1) List the major components of blood. Briefly describe their function and differentiate between the cellular components and the liquid components.

**CELLULAR:**
- red blood cells (erythrocytes) – carry oxygen
- white blood cells (leukocytes) – immune function
- platelets – blood clotting

**LIQUID:** Plasma – water, glucose, amino acids, ions (electrolytes), hormones, carbon dioxide

2) Distinguish between a THROMBUS and an EMBOLUS.

**Thrombus:** clot

**Embolus:** when a piece of a clot breaks off and moves through the circulatory system

3) The victim of a car accident is brought in to the emergency room where it is determined that she will need several units of blood. Her blood type is A-positive (A+). List four blood types that would be safe to give to this patient. If she receives the “wrong” blood, what will happen?

An A+ person can receive A+, A-, O+, and O-.
If given the wrong type, the RBCs will agglutinate or clump together.

4) Trace a red blood cell’s pathway from the superior vena cava to the aorta. Include all valves, chambers, organs, and vessels passed through.

SVC → right atrium → right A-V valve (tricuspid) → right ventricle → pulmonary valve → pulmonary artery → lungs → pulmonary vein → left atrium → left A-V valve (bicuspid) → left ventricle → aortic valve → aorta

5) Why does the left ventricle have thicker, more muscular walls than the right ventricle?

**Blood is being pumped out to entire body**
6) Summarize the steps of the CARDIAC CYCLE.

Pacemaker cells of the SA node initiate contraction impulse; SA node impulse to AV node causes atrial systole; AV node passes impulse to AV bundle and then throughout apex which leads to ventricular systole (contraction)

7) Distinguish between the SYSTEMIC CIRCUIT and the PULMONARY CIRCUIT.

SYSTEMIC CIRCUIT: blood from heart out to body and back
PULMONARY CIRCUIT: blood from heart out to lungs and back

8) What do the numbers in your blood pressure tell you (ex: if your blood pressure is 122/68, what do the 122 and 68 mean?)

when the ventricles contract, the blood exerts a force/pressure of 122mmHg on arterial walls as the blood moves through the brachial artery; when the heart is in diastole (relaxing), the blood exerts a force/pressure of 68mmHg on the brachial artery wall

9) What are the characteristic “heart sounds”? lub–dub

What causes this sound? Lub: blood hitting the AV valves during ventricular systole

Dub: blood hitting the pulmonary & aortic valves at the beginning of diastole

UNIT 7: The Respiratory System

1) Trace the path of oxygen (O₂) from the moment it enters the nose until it diffuses into a muscle cell in the foot.

Nose → pharynx → larynx → trachea → primary bronchi → secondary bronchi → tertiary bronchi → bronchioles → alveolar sac → capillaries → venule → pulmonary vein → left atria → left AV valve (bicuspid) → left ventricle → aortic valve → aortic arch → descending aorta → common iliac artery → External iliac artery → femoral artery → popliteal artery → tibial artery → artery in foot (we didn’t learn name) → Arterioles → capillary bed in foot → diffuse into muscle cell in the foot

2) Explain a normal inspiration (inhalation) and a normal expiration (exhalation) using what you know about pressure changes in the chest cavity. Include the role of muscles (diaphragm, intercostals) and the pleural membranes.

Inhalation: diaphragm and intercostal muscles contract → increases volume of thoracic cage → decreases pressure in alveolar spaces → higher pressure air outside body moves into lower pressure region inside lungs

Exhalation: diaphragm and intercostal muscles relax → decreases volume of thoracic cage → increases pressure in alveolar spaces → higher pressure air inside lung space moves out to lower pressure region which is outside the body

3) Summarize the gas exchanges that occur in the:

a) alveolar sacs → blood vessels: oxygen moves from the alveolar sac into the blood capillaries but carbon dioxide moves from blood capillaries into the alveolar sac space

b) blood vessels → body cells: oxygen moves from the blood capillaries into the body cells but carbon dioxide moves from the body cells into the blood capillaries

4) What is the function of cilia in the trachea and bronchi?

Cilia move mucus that has trapped particles up and out of the bronchi and trachea
5) How does an increase in the amount of CO₂ affect your breathing rate and why?
The more carbon dioxide that diffuses into the blood plasma (contain a lot of water), the more acidic your blood becomes (lowers the pH); the low pH is detected and this causes you to breathe faster

Unit 8: The Digestive System

1) List the:
   a. parts of the alimentary canal:
      mouth, esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (cecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum), anus
   b. accessory organs of the digestive system: salivary glands, liver, pancreas

2) Describe the digestive functions of saliva (both chemical and other).
   Chemical: contains salivary amylase which begins chemical digestion of carbohydrates
   Other: mucus helps protect the mouth from abrasion; saliva helps make taste possible; saliva helps bind food together in a bolus

3) List the function of the gallbladder. Store bile Where is the gallbladder located? Underneath the liver

4) How does mechanical digestion assist chemical digestion? Mechanical digestion increases surface area so that the enzymes can perform chemical digestion

5) What is the difference between pepsin and pepsinogen? Pepsin is the active version of the protein digesting enzyme found in the stomach (pepsinogen is the inactive version that is converted to pepsin by hydrochloric acid: HCl)

6) What is the function of following structures on the digestion of a cheeseburger (on a bun) with lettuce and tomato that you ate for lunch:
   a. mouth: teeth increase surface area and salivary amylase begins carbohydrate digestion; tongue forms chewed up food into a bolus
   b. pharynx: pharynx passes bolus to esophagus
   c. Esophagus: peristalsis and gravity move the bolus to the stomach
   d. cardiac sphincter: must open to allow food into the stomach; keeps acidic gastric juice out of the esophagus
   e. stomach: stomach movements continue mechanical smashing of food; chemical digestion of proteins begins (gastric juice contains HCl and pepsin)
   f. pyloric sphincter: regulates the rate at which chyme passes from stomach into small intestines
   g. small intestine (there is more than 1 function here): finish the chemical digestion of carbohydrates and proteins; do all the chemical digestion of lipids and nucleic acids; absorb water; absorb nutrients into villi
   h. pancreas: make a bicarbonate solution to neutralize the acidity of chyme and make lots of digestive enzymes; both of these are sent to the duodenum
   i. liver: make bile
   j. gallbladder: store bile; release bile into the duodenum
   k. large intestine: absorb vitamins produced by the bacteria that are there; absorb water; make feces
7) Where is the appendix located (specifically)?  
**Attached directly to the cecum**; Does it have a Digestive System function? NO  
What is its Lymphatic System function? **Contains immune system cells (lymphoid tissue)**

8) Complete the table below:

<table>
<thead>
<tr>
<th>Digestion of...</th>
<th>Where occur in body (list start &amp; stop)?</th>
<th>Enzymes involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>Start: mouth; end: small intestines</td>
<td>Salivary amylase; pancreatic amylase</td>
</tr>
<tr>
<td>Protein</td>
<td>Start: stomach; end: small intestines</td>
<td>Pepsin; proteases</td>
</tr>
<tr>
<td>Nucleic acid</td>
<td>Start and end: small intestines</td>
<td>Nucleases</td>
</tr>
<tr>
<td>Fats</td>
<td>Start and end: small intestines</td>
<td>Lipases</td>
</tr>
</tbody>
</table>

9) Complete the chart below:

<table>
<thead>
<tr>
<th>Enzyme / *substance</th>
<th>Where is it made? (list all locations)</th>
<th>What digested products results from this chemical reaction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>lipase</td>
<td>Pancreas; cells of the small intestine</td>
<td>Glycerol and fatty acid chains</td>
</tr>
<tr>
<td>amylase</td>
<td>Salivary glands and pancreas</td>
<td>Monosaccharides</td>
</tr>
<tr>
<td>protease</td>
<td>Cells in gastric pits (of stomach); pancreas; cells of the small intestine</td>
<td>Amino acids</td>
</tr>
<tr>
<td>*Bile</td>
<td>liver</td>
<td>Turns big fat blob into small fat blobs</td>
</tr>
</tbody>
</table>

10) What are gallstones? **Crystallized cholesterol**

11) What is heartburn? **Stomach acid getting into esophagus**

12) What are hemorrhoids? **Swollen/Inflamed veins of the anus**

**Unit 9: The Excretory System**

1) What is the functional unit of the excretory system? **nephron**

2) Briefly describe what happens in each of the 4 excretory system processes:
   a. filtration: **molecules are filtered from the blood into Bowman’s capsule** (filtration occurs by size and any small molecules can filter)
   b. reabsorption: **molecules that the body needs are reabsorbed back into the blood from the nephron**
   c. secretion: **molecules that the body needs to get rid of but are too big are secreted (added) into the nephron from the blood**
   d. excretion: **everything that is left in the collecting duct leaves the body**
3) Draw and label a nephron. Afterwards, add what is filtered, reabsorbed, secreted, and excreted into your diagram.

ADH binding to receptor

If total blood concentration is too high (concentrated), ADH is released from posterior pituitary into blood stream. ADH binds to receptors in membrane of cells in the distal tubule and collecting duct. When ADH binds, distal tubule & collecting duct become more permeable to water and water is reabsorbed into bloodstream. This decreases the concentration of the blood (back to homeostasis) and increases the concentration of urine.

4) In urine, what solute is in the highest concentration? **urea**

5) What makes up the largest percentage of urine overall? **water**

UNIT 10: The Lymphatic System & The Immune System

1) What are the function of lymph nodes?
   - filter potentially harmful foreign particles from lymph
   - are centers for the aggregation of lymphocytes (attack invading viruses, bacteria, parasites, etc.)
   - contain phagocytic cells (engulf and destroy foreign substances, damaged cells, cellular debris)

2) List and describe the physical and chemical components of the NONSPECIFIC DEFENSES.
   **physical components of nonspecific defense:**
   - skin, sweat, mucus

   **chemical barriers of nonspecific defense:**
   - HCl, lysozyme (in tears), interferon, salt (in sweat)

   **FYI: other components of your body’s nonspecific defenses:**
   - fever, inflammation, phagocytic cells (ex: macrophages and neutrophils)
3) Distinguish between an ANTIGEN and an ANTIBODY.

- An antigen is a foreign molecule that triggers an immune response
- An antibody is a protein made by a Plasma cell (which developed from an activated B cell) which can specifically target the antigen that started the 3rd line of defense

4) Create a chart to compare T cells to B cells: Where do they originate? Where do they mature? What are the different types of each one and what is the general function of each type? (example table below)

<table>
<thead>
<tr>
<th>Lymphocyte Cell Type</th>
<th>Originate</th>
<th>Mature</th>
<th>Different subtypes</th>
<th>General function</th>
</tr>
</thead>
<tbody>
<tr>
<td>T cells</td>
<td>Red bone marrow stem cells</td>
<td>thymus</td>
<td>Helper T cell</td>
<td>Activate both the cellular (cytotoxic T cell) and humoral response (B cell) → 3rd line of defense</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cytotoxic T cell</td>
<td>Release perforin to destroy infected body cells or cancerous body cells</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Memory cell</td>
<td>Provide fast responding immunity if infected a 2nd time; the antibodies that memory cells make are more numerous and stick to the antigen better than those made from the 1st time infected by same antigen</td>
</tr>
<tr>
<td>B cells</td>
<td>Red bone marrow stem cells</td>
<td>Red bone marrow</td>
<td>Plasma cell</td>
<td>When a B cell is activated by a Helper T cell, it becomes a plasma cell; plasma cells make and release antibodies that can target the specific antigen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Memory cell</td>
<td>Provide fast responding immunity if infected a 2nd time; the antibodies that memory cells make are more numerous and stick to the antigen better than those made from the 1st time infected by same antigen</td>
</tr>
</tbody>
</table>

5) Distinguish between:
   a. primary and secondary immune response:
      * primary: 1st time exposed to a specific antigen (produces memory cells)
      * secondary: 2nd time exposed to a specific antigen (uses memory cells)

   b. active and passive immunity (naturally acquired and artificially acquired for each):
      * active: exposed to antigen and 3rd line of defense activated (make antibodies and memory cells)
        * naturally acquired: exposed to actual antigen so you got sick and got better
        * artificially acquired: exposed to modified version of antigen; vaccination

      * passive: only receive antibodies
        * naturally acquired: antibodies are passed from mother to child (through placenta while pregnant or through breast milk while nursing)
        * artificially acquired: get an injection of antibodies (ex: rabies shot)

   c. an antigen and an allergen:
      * antigen: foreign molecule that triggers an immune response
      * allergen: nonharmful antigen that triggers immune response when there isn’t an actual threat to the body
6) What is a vaccine and what is the purpose of getting vaccinated (what is being created that you want)?
Vaccines are weakened, modified, or killed versions of the antigen; entire 3rd line of defense is activated but the creation of memory cells is the key.

7) Which type of illnesses can be treated with antibiotics and which cannot? Only bacterial infections can be treated with antibiotics (NOT viruses!)

8) What is meant by “autoimmunity”? When your immune system is attacking your own body cells (Cytotoxic T cells destroying body cells or autoantibodies being made against your own body cells)
List 2 examples of autoimmune disorders. Type 1 diabetes (insulin making cells of pancreas destroyed); multiple sclerosis (MS: T cells destroying myelin sheath around neurons); Grave’s disease (autoantibodies); Lupus (autoantibodies attack DNA); Rheumatoid arthritis (autoantibodies attack cartilage cells of joints); Crohn’s (autoantibodies attack alimentary canal)

9) In any organ transplant procedure, what is the greatest concern or risk? Rejection of the transplant
What 2 things are done to reduce the risk of this happening? Match the donor with the recipient and take immune system suppressing drugs for the rest of your life

UNIT 11: The Reproductive System
1) List the general functions of the male and the female reproductive systems.
   1) Make sex hormones
   2) Make sex cells
   3) Male: get sex cells to vagina; Female: protect & support developing baby

2) Describe the composition of semen and where each of the components comes from.
   - Sperm: made in seminiferous tubules
   - Sugar/nutrients & prostaglandins: seminal vesicles
   - Alkaline solution to neutralize the acidity of the vagina: prostate gland

3) List and briefly describe the three phases of the OVARIAN CYCLE and the MENSTRUAL CYCLE.
   **OVARIAN CYCLE:**
   1) Follicular Phase: follicle matures (stimulated by FSH) & as it grows bigger, it secretes more and more estrogen
   2) Ovulation: mature egg leaves follicle & ovary (caused by LH spike)
   3) Luteal Phase: follicle tissue becomes the corpus luteum & it now secretes estrogen & progesterone (progesterone maintains uterine lining AND inhibits the release of FSH)

   **MENSTRUAL CYCLE:**
   1) Menstruation: because fertilization did not occur, uterine lining is shed from previous cycle
   2) Proliferative Phase: uterine lining rebuilds (stimulated by estrogen)
   3) Secretory Phase: uterine lining becomes very vascularized & it secretes glycogen (glycogen used by blastocyst/embryo as its energy source)
4) Draw and label a concept map of the hormones involved in the male reproductive system. 
→ don’t forget to include connecting terms/phrases linking your information together

5) Draw and label a concept map of the hormones involved in the female reproductive system.

**Be familiar with the various methods of contraception & the general symptoms of STDs.

**Know diagrams from EACH unit.